DEPARTMENT OF WATER RESOURCES

LEVEE EVALUATION PROGRAM

Electromagnetic (EM) Survey

Updated Winter 2008

Reflecting Governor Arnold Schwarzenegger's long-term commitment to improving flood safety to prevent possible catastrophic flooding and loss of life, the State of California's Department of Water Resources (DWR) is undertaking unprecedented efforts to evaluate and upgrade aging and deteriorating levees in the Sacramento and San Joaquin River Valleys and Delta.

Of highest priority, DWR is fully evaluating more than 300 miles of urban project levees in these areas, with plans to later survey the entire 1,600 miles of project levees in the Central Valley. Funding for the levee evaluation efforts is provided through two large flood control bonds approved by California voters in November 2006, Propositions 84 and 1E.

To get a detailed picture of the Central Valley flood control system's current condition, experts study a wide range of critical levee properties, including geomorphology (the forces that alter land features), levee topography (the configuration of levee surfaces), subsurface geologic and groundwater conditions, the water levels of rivers and channels, historical events, man-made conditions, and erosion conditions. A number of proven methods and innovative technologies are being used to assess the levees' structural integrity and identify which areas are most in need of improvements or repairs.

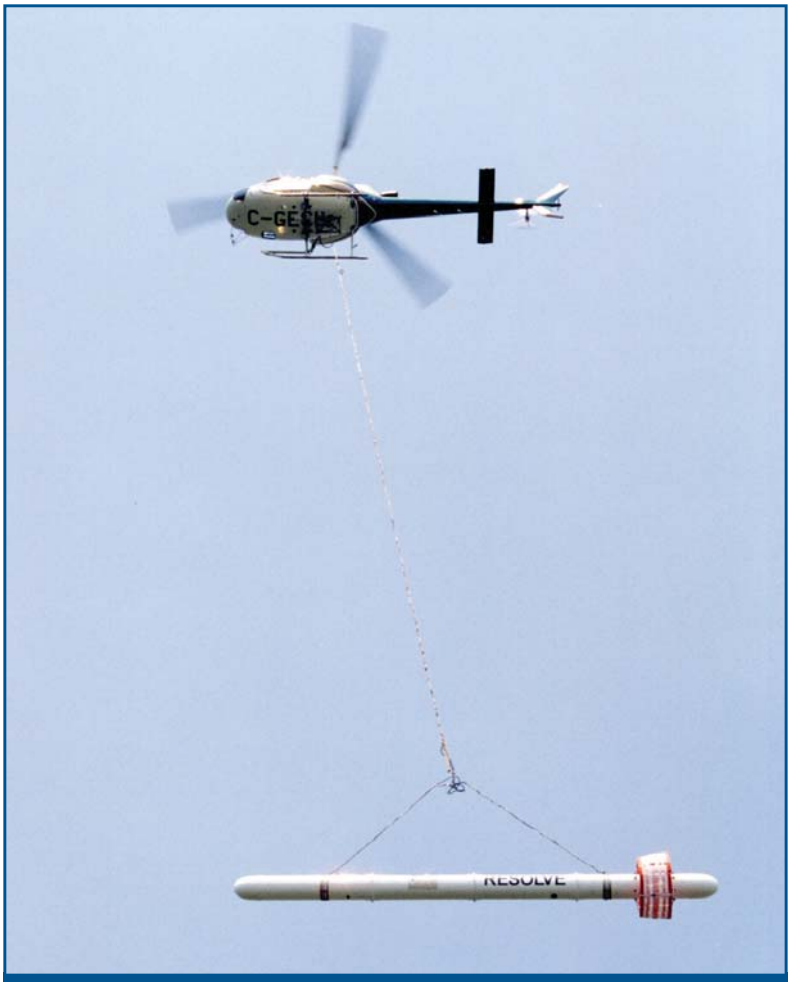
DWR has dedicated a website for those interested in the levee repair and evaluation efforts. To view repair and survey locations and other levee information, please visit:

www.water.ca.gov/levees

Airborne Electromagnetic Surveys

Geophysical electromagnetic (EM) surveys are one of the unique tools experts are using to examine levee subsurface conditions. Airborne EM surveys are conducted during low-level helicopter passes over selected levees. An airborne sensor, which resembles an airborne torpedo *(see photo)*, is suspended from the helicopter about 100 feet above the levees. As the helicopter flies parallel to the levees, the EM technology senses variations in the ground's electrical conductivity to depths of more than 100 feet underground. The goal is to map important changes in soil types and ground conditions, identifying zones where permeable soils are present or excessive water penetration is taking place.

EM surveys were conducted in late summer 2007 over more than 200 miles of Central Valley levees. From Oroville in the north to Lathrop in the south, the flights took place along the Feather River, Bear River, American River, Sutter Bypass, Yolo Bypass, Sacramento River, Stanislaus River, San Joaquin River, and their tributaries.



EM helicopter survey flights have been conducted along levee systems that provide critical flood protection for the urban areas of Marysville/ Yuba City, Sacramento, and Stockton/Lathrop. The flights were conducted in late-summer 2007.

Because homes, businesses, and other sensitive land uses are close to parts of the levee system, DWR is coordinating with elected officials, community leaders, residents, law enforcement, and the media to ensure that local communities are aware of the purpose and timing of the flyovers.

Airborne Electromagnetics – Frequently Asked Questions

What is "airborne electromagnetics"?

Airborne electromagnetics (AEM) is an airborne geophysical technology developed for use in the mining industry to locate and map bodies of ore. It works by measuring variations in the electrical conductivity of the ground. In so doing, AEM is able to detect and map geological changes and variations beneath the earth's surface.

How does it work?

Electrical conductivity is measured using a helicopter carrying a torpedo-shaped aerial sensor that houses an electromagnetic transmitter and receiver system. The system transmits an electromagnetic field (radio waves) into the ground and then measures the response that returns from the ground. The strength of the response changes as the geology of the earth changes. The data collected are processed into mapped images that give geophysicists a composition model of the earth's subsurface.

What is the survey procedure?

The sensor tube is 30-feet long and weighs about 600 pounds. It is suspended about 100 feet below the helicopter, which flies about 200 feet above the ground. The helicopter travels an average of 35 miles per hour in parallel lines across the area to be mapped. Based at nearby airfields, the helicopter typically departs in the morning and surveys during much of the day, weather and flying conditions permitting. It may land during the day to refuel, but it does not fly at night.

Is airborne electromagnetics a safe technology?

AEM is safely used throughout the world in mineral exploration and the evaluation of land features and natural resources. The electromagnetic field generated by this system is considerably weaker than the fields generated by natural and man-made sources surrounding us every day. All operations must pass strict government aviation regulations, and the aircraft are flown by specialists who have many decades of experience collecting data in a wide variety of flying environments. The helicopter stays high enough that there is no rotor wash (wind) felt on the ground. It also keeps well above power lines and other obstacles. The survey sensor is securely fastened with a stainless-steel wire rope and a backup Kevlar safety rope.

Does it affect livestock?

The technology causes no ill effects to livestock and horses, but because low-flying helicopters are involved, there is the potential for livestock to be alarmed.

Does it affect electronic or communications equipment?

Because the electromagnetic field generated by the equipment is weak, electronic or communications equipment is not adversely affected. ■

Survey helicopter lifting off.

As the helicopter flies over the levees with the survey sensor suspended below, electromagnetic equipment records data about subsurface soil conditions.

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